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EXAMINE THE EFFECT OF DIFFERENT FACTORS ON TESTOSTERONE AND MALE REPRODUCTIO SYSTEM

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ABSTRACT

The health of parents determines the development of their children and a link between paternal diet, metabolic health, body weight and semen parameters have been shown. Various factors may influence semen parameters and in this study the effect of micro-nutrient and omega-3 supplementation on semen parameters was investigated by evaluating semen parameters and fatty acid composition of intact semen at baseline and three months after intervention. The study also investigated the effect of age, environmental-, lifestyle-, anthropometric and dietary factors on semen parameters. A place-controlled intervention study on 50 apparently healthy volunteers between the ages of 18 and 45 years was conducted and data collection took place at the Faculty of Health Sciences, University of the Free State. Participants completed a self-reporting questionnaire to report on age, environmental-, lifestyle- and dietary factors. Standard techniques were used to obtain anthropometric measures and physical activity was determined using the self-administered short International Physical Activity Questionnaires (IPAQ). Two semen samples were collected and the average used to provide a representative reflection of sperm parameters.

Keywords: -Testosterone, Male, Lifestyle, Female, Health.

I. INTRODUCTION

The male reproductive system is discussed in detail in this chapter. Male and female fertility, as well as the variables that affect male fertility, are discussed. Age, environmental, lifestyle, and nutritional variables, as well as particular nutrients, are discussed in relation to their impact on semen parameters.

Maternal health is particularly important (Black et al 2013:427; Black et al 2008:243; Ferguson-Smith and Patti 2011:115; Levy et al 2005:182), although both parents' health and lifestyles affect their children's health and development. Additional evidence from animal and human research suggests a connection between a father's nutrition, metabolic health, body weight, and semen parameters and the health of the mother throughout pregnancy and the development of the embryo (Binder et al. 2012:e52304).

Before intrauterine development occurs, Wu and Suzuki (2006:201) hypothesized that a human child's body fat percentage might be affected by the food of the father. According to the study authors, a father's diet may have an effect on his children's health even into adulthood. Indicators of male health may be found in sperm parameters (Jensen et al., 2009:559).

Semen parameters may be affected by a number of external causes. A variety of variables, including age, environment, and lifestyle, anthropometrics, food, and nutrient consumption, have been linked to sperm quality and quantity.

II.DEVELOPMENTOFTHEMALEREPRODUCTIVESYSTEMDURINGTHEEMBRYONICPHASE

The external genitalia of males and females are essentially identical throughout the first six weeks of embryonic development (Fox 2013:703,705, Sherwood 2013:778). One genitalia will have a labioscrotal or genital enlargement on either side, while the other will have a genital tubercle, urethral folds, and a urogenital sinus (Fox 2013:705, Sherwood 2013:778). The penis, spongy urethra, prostate, and scrotum are formed at this time due to the testes' secretions (Fox 2013:704, Sherwood 2013:778). The ductus or vas deferens, the ejaculatory duct, and the seminal vesicles are all offshoots of the wolffian duct, and they are all stimulated by testosterone (Fox 2013:706, Sherwood 2013:779).

The testicles emerge from the gonadal ridge in the posterior of the abdominal cavity during embryonic development (Cohen and Wood 2000:418; Sherwood 2013:781). The testes begin their sluggish descent from the abdominal cavity down the inguinal canal and into the scrotum during the last months of foetal development, when they are eventually deposited into the pockets of the scrotum sac (Cohen and Wood, 2000; Fox, 2013; Sherwood, 2013; 781–782). Testosterone secreted by the foetal testes prompts the testicles to descend into the scrotum, a process that is typically complete by the seventh month of gestation (Sherwood 2013:782), at birth (Sharpe 2010:1703), shortly after birth (Fox 2013:704), or at the very latest, before puberty (Sherwood 2013:782). A spermatic cord, made up of blood vessels, lymphatic vessels, nerves, and the ductus deferens, connects each testis to the body through the inguinal canal (Cohen and Wood 2000:418). (Cohen and Wood, 2000:418) The ductus deferens is responsible for transporting sperm from the testis.

III.THEPRODUCTIONOFTESTOSTERONE

Testicles are external organs, dangling in the scrotum between the legs (Cohen and Wood 2000:418). Adult male gonads, also known as testes, measure between 3.7 and 5.0 by 2.5 cm in size (Cohen and Wood 2000:417, 418; Iammarrone et al. 2003:212) or contain 20.7 to 5.0 ml in volume (Jensen et al. 2004); the left testis is slightly smaller (23.9 to 1.3 cm3) than the right testis (24 to 3 by 1.2 cm3).

The testes have two parts—the seminiferous tubules, where spermatogenesis occurs, and the interstitial tissue, which contains Leydig cells, responsible for testosterone secretion (Cohen and Wood 2000:418; Fox 2013:711; Karavolos et al. 2013:2; Sherwood 2013:782, 779)—and are responsible for producing sperm and testosterone, respectively. Despite their obvious differences in structure and function (Sherwood 2013:782), the two halves of the testes are intricately interconnected (Fox 2013:712,714). Eighty percent to ninety percent of an adult male's testicular mass comes from the seminiferous tubules (Fox 2013:711, Sherwood 2013:782). Spaces between seminiferous tubules are filled with interstitial tissue, a delicate network of connective tissue (Fox 2013:711, Sherwood 2013:782). Most of the cells in the interstitial tissue are Leydig cells, but there are also many blood and lymphatic capillaries there that carry the hormones produced in the testicles.

Follicle-stimulating hormone (FSH) enhances spermatogenesis in the tubules (Fox 2013:712,717), whereas luteinizing hormone (LH) boosts testosterone release by the Leydig cells. The male equivalent of LH, ICSH (Fox 2013:708), is known as LH. FSH attaches to Sertoli cells, where it stimulates spermatogonial proliferation and spermatocyte maturation (Karavolos et al., 2013:2), although it is unable to finish the process on its own. LH is also critical in sperm development (Karavolos et al., 2013:2).

IV. THEEFFECTOFAGEONTESTOSTERONEANDMALEREPRODUCTIVETRACTSECRETIONS

Age-related suppression of testosterone production is a mysterious cause (Fox 2013:713). Since gonadotropin concentrations persist at high levels despite testosterone's drop, it's unlikely that a drop in gonadotropin secretions is to blame for the loss in testosterone production (Fox 2013:713).

Beginning at about the age of 20 (Cohen and Wood 2000:422, Fox 2013:713), testosterone secretion and spermatogenesis begin to decline and remain low throughout a man's life. At the beginning of the 80s, most people experience hypogonadal states (3.2ng/mL) (Cohen and Wood 2000:422, Fox 2013:713). However, sperm production continues in a minority of men (less than 10%) even beyond age 80 (Cohen and Wood 2000:422). Loss of lean muscle and bone mass may be attributed to a decline in testosterone secretion, which is further exacerbated by a lack of physical exercise, obesity, and some medicines or prescription (Fox 2013:713).

The viscosity of the fluids produced by the prostate and seminal vesicles decreases with age (Cohen and Wood, 2000:422).

The examination of male fertility has traditionally relied on sperm analysis (Karavolos et al. 2013:4,7; Krausz 2011:273; Pacey 2012:739). A skilled technician analyzes fresh ejaculate for sperm using laboratory procedures outlined by the WHO (Karavolos et al. 2013:273, Pacey. 2012:739). At least two semen samples should be analyzed in clinical practice to determine semen quality (Carlsen et al., 2004; Quallich, 2006; WHO, 2010). Semen analysis provides important information on the clinical state of the man (Karavolos et al. 2013:5, WHO 2010:8-9), however it is not possible to predict the fertilizing potential of the sperm that actually reach the fertilization site from the measurements taken on the whole ejaculate. Standardized methods must be used in the collection and analysis of sperm to provide reliable results (WHO, 2010, p.9).

There is a correlation between the amount of time that passes between ejaculations and the number of sperm present or their concentration (De Jonge et al. 2004:57; Karavolos et al. 2013:5; Sherwood 2013:761; 794). Ejaculate sperm volumes range from 1.5 to 6.0 ml (Fox 2013:720; Sherwood 2013:761; 794) According to the World Health Organization (2010:224), the 5th centile with a 95% confidence interval is 1.5 (1.4-1.7) ml (Table 2.2) as the lowest reference level. The prostate contributes an additional 15-30% of semen to the total, with the seminal arteries responsible for the remaining 45-80% (Fox 2013:720). A total sperm count per ejaculate of less than 40 x 106, as reported by Fox (2013:721), may be clinically significant and contribute to male infertility. The World Health Organization (2010:224) states that the minimum acceptable sperm concentration is 15 (12-16) x 106 per ml of ejaculate, while the minimum acceptable total sperm number is 39 (33-46) x 106 per ejaculate.

V.FACTORSINFLUENCINGSEMENPARAMETERS

Age

A research conducted on a random sample of young men (18 years old) who were obligated to serve in the Danish military found that sex characteristics were influenced even at a young age. Even at an early age, several of these guys showed signs of poor semen quality, which might have an effect on fertility (Andersen et al., 2000:366,368,371).

Stewart and Kim (2011:498–499) reveal in a review paper that reproductive function declines with aging. Menopause has a profound impact on sperm quality and quantity, including semen volume, sperm motility, total motile sperm, concentration, total sperm count, morphology, and reactive oxygen species (ROS) content (Chen et al. 2003:226,229; Cocuzza et al. 2008:490; Cooke and Nelson 2011:167; Eskandar et al. 2012:3; Eskenazi et al. 2003 Researchers have shown that elderly men's sperm had more DNA damage (Schmid et al. 2007:180,184; Varshini et al.

Environmentalfactors

Temperatures between 34.2 and 34.6 degrees Celsius are ideal for spermatogenesis (Agarwal et al. 2008b:550, Ivell 2007: Online). An increase in intrascrotal temperature may have a detrimental effect on semen parameters (Agarwal et al. 2008b:550, Ivell 2007: Online, Kefer et al.

Increases in scrotal temperature and decreases in semen parameters, Jung and Schuppe 2007, Magnusdottir et al 2005:208, Sharpe 2010:1697,1703, Sheinkin et al 2005:452,453,454, Thonneau et al 1998:2124) have been linked to occupations that require long periods of sitting (truck or taxi drivers) or exposure to heat sources (welders, bakers, Another disadvantage of sitting is that airflow is restricted around the scrotum, making cooling less efficient (Sharpe 2010:1703). Since elevated scrotal temperatures have a detrimental effect on sperm quality, working seated for long periods of time is associated with worse sperm quality (Jung and Schuppe 2007:203,205,212; Magnusdottir et al. 2005:208).

Lifestylefactors

Modifiable behaviors and environmental variables have an effect on overall health and reproductive potential (Campagne 2013:214, Homan et al 2007:209, 219).

Homan et al. (2007) and Haskell et al. (2007) both state that regular exercise is an important aspect of a healthy lifestyle that may improve overall health and well-being. Obesity, cardiovascular disease, hypertension, diabetes, osteoporosis, and psychological stress are among lifestyle disorders that exercise may help prevent (Homan et al. 2007:213). The majority of South Africans do not seem to be getting enough exercise to boost their health (Botha et al., 2013:S18).

Extreme sports, such as marathon running and weightlifting, may lead to poor semen quality (Dohle et al., 2005:708), and pressure on the perineal region during long-distance cycling may impair erectile function (Quallich, 2006:279), even though exercise is a necessary element of a healthy lifestyle. Vigorous male exercisers who are thin or underweight may have lower fertility, according to research (Sharma et al. 2013:76).

Researchers should also look at how alcohol consumption affects sperm concentration, motility, and semen volume (Li et al., 2011; Practice Committee of the American Society for Reproductive Medicine, 2015:e19). Alcohol use is associated with elevated testosterone levels and decreased sex hormone binding globulin (SHBG) levels (Jensen et al 2014:Online). Semen volume, sperm count, motility, and morphology may all be adversely affected by alcoholism (Gaur et al., 2010:35; Muthusami and Chinnaswamy, 2005:919,922).

Weight

Being underweight has a deleterious effect on semen parameters, as stated by Qin et al. (2007:827) and Jensen et al. (2004:863). However, a study by Hammoud et al. (2008a:900,902) suggests that a number of mechanisms may contribute to the impact of obesity on sperm production and infertility. Although a systematic review and meta-analysis (MacDonald et al. 2010; 293; Zhang et al. 2014; 1861; 1863) found that low testosterone and sex hormone binding globulin (SHBG) concentrations were associated with reduced fertility in overweight and obese men, Teerds et al. (2011:667) reported that infertility is not a major issue in most overweight and obese men. Reproductive potential in males who are overweight or obese does not always decrease as a result of changes in reproductive hormone concentrations (Chavarro et al., 2010:2222). Several studies (Aggerholm et al. 2008:619,625, Chavarro et al. 2010:2222,2225-2227,2230, Duits et al. 2010:1356-1358, Hammoud et al. 2008a:902) agree that being overweight or obese has a negligible impact on sperm quality.

Dietaryintake

Increased seminal oxidative stress has been associated to poor, imbalanced diets and heavy alcohol use (Kefer et al 2009:453,454, Koch et al 2004:191). Antioxidants like vitamins A, ß-carotene, E, and C are abundant in foods like vegetables, fruits, nuts, and whole grains (Al-Azemi et al. 2009:584, Gallagher 2012:60,71,84,88,89), and they help to minimize oxidative damage to sperm, keep sperm cells intact (Cheah and Yang 2011:182, Sharma et al. 2013:67, Wong et al. Showell (2011:6) claims that getting enough antioxidants in one's diet is crucial for producing high-quality sperm.

Wong et al. (2003:53) identified a lack of fruit and vegetable consumption as a contributor to male factor sub-fertility. A favorable correlation between fruit consumption and sperm motility was shown by Braga et al (2012:53,55,56). Lycopene, a phytochemical present in tomatoes and other fruits and vegetables, has been related to increased numbers of motile sperm and healthier sperm overall. (Mendiola et al. 2010:1128,1130,1131, Mnguez-Alarcón et al. Braga et al. (2012:53,55,56) discovered that the quality of sperm, especially sperm motility, improved with a higher fruit consumption, but they found no correlation between diet and sperm morphology. Student semen volume rose when they ate more fruits and vegetables high in vitamin C (Mnguez-Alarcón et al 2012:2807,2810- 2813).

VI. CONCLUSION

In conclusion, several factors have been found to influence testosterone levels and the male reproductive system. These factors can have significant effects on men's overall health and well-being.

Firstly, age plays a crucial role in testosterone production. Testosterone levels tend to peak during adolescence and early adulthood, and then gradually decline with age. This decline in testosterone can lead to various changes in the male reproductive system, including reduced sperm production, erectile dysfunction, and decreased libido.

Secondly, lifestyle factors such as diet and exercise have a significant impact on testosterone levels. A healthy diet rich in essential nutrients, including vitamins, minerals, and antioxidants, can help maintain optimal testosterone production. Regular exercise, particularly resistance training, has been shown to increase testosterone levels and improve overall reproductive health.

Additionally, obesity and excess body fat have been linked to lower testosterone levels. Adipose tissue can convert testosterone into estrogen, leading to an imbalance between the two hormones. This imbalance can negatively affect male reproductive function and contribute to conditions such as infertility and erectile dysfunction.

Stress is another crucial factor that can influence testosterone levels. Chronic stress can lead to elevated levels of cortisol, a stress hormone that inhibits testosterone production. Prolonged exposure to stress can disrupt the delicate balance of hormones in the body and affect reproductive health.

Environmental factors, such as exposure to endocrine-disrupting chemicals (EDCs), can also impact testosterone levels. EDCs, found in certain plastics, pesticides, and other products, can mimic or interfere with the body's natural hormones, including testosterone. This interference can disrupt normal reproductive function and potentially lead to fertility issues.

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